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AUTHOR Gunawardena, Charlotte
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ABSTRACT

The purpose of this paper is threefold: (1) to discuss issues related to the design of interaction on the World Wide Web using models of interaction developed for distance education; (2) to examine several techniques for the analysis of interactions and the quality of the learning experience in a computer-mediated group conference; and (3) to propose a model for analyzing the social construction of knowledge in such a group conference. The paper provides guidelines for both designers and evaluators of Web-based instruction. The definition of interaction in a computer mediated communication (CMC) environment is examined since definitions of interaction for interpersonal communication used by communication researchers to study face-to-face dialogue do not transfer well to the CMC context. Three types of interaction are discussed: learner-content, learner-instructor, and learner-learner. The strengths and shortcomings of the interaction analysis techniques that have been developed are pointed out, and a model for analyzing the quality of CMC interactions and learning experiences is proposed. The application of this model for analyzing interaction is briefly discussed. (Contains 17 references.) (MES)

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THE CHALLENGE OF DESIGNING AND EVALUATING 'INTERACTION' IN WEB-BASED DISTANCE EDUCATION

Charlotte Gunawardena
University of New Mexico
lani@unm.edu

INTRODUCTION

The World Wide Web (WWW) is increasingly being used as a medium to deliver distance education at the post-secondary level. However, an examination of a significant number of web-based courses for adult learners indicates that they are predominantly designed to transmit information to the learner rather than foster the teaching and learning process in a dialogic manner. These courses disregard Knowles'(1990) principles of andragogy especially the principle of using the adult learner's experience in a learning situation, and lack the design of interaction that promotes collaborative learning. This view was confirmed by Boshier et. al. (1997) in their survey of web-based courses for adult learners. They note that while the web holds considerable potential for learner interaction, few courses use much of its interactive capability. Most do not provide opportunities for collaborative learning. They note that the chief difficulty is not technological, but conceptual, as many instructional designers or teachers are obsessed with objectives and the assessment of students and arranging information in a hierarchical order. They have unwittingly or naively endorsed a transmission model of learning similar to what happens in a traditional or face-to-face classroom.

If the web is to be used as a versatile medium for adult learning, then, careful attention must be paid to the design of interaction that can foster the negotiation of meaning, the validation of knowledge, and the construction of knowledge through social negotiation. Learner - centered learning environments based on constructivist principles where the focus is on learner initiated inquiry and exploration are far more suitable for adult learners than the transmission model of learning which is based on the notion that learners are empty vessels to be filled up with the teacher's knowledge. Constructivist learning environments provide multiple perspectives and real world examples, encourage reflection, and support collaborative construction of knowledge through social negotiation (Jonassen, 1994). Instructional design models based on behaviorist principles that are used to design and develop instruction for traditional classes do not offer much guidance for the design of instructional strategies for two-way interactive distance education systems. Instructional designs must address the complex interrelationships between learning task, media attributes and the learner's cognitive processes. The design of interaction that facilitates adult learning and the evaluation of the learning experience that occurred as a result of that interaction has been a challenge to many web designers.

THE PURPOSE OF THIS PAPER

The purpose of this paper is three fold: 1) to discuss issues related to the design of 'interaction' on the web using models of interaction developed for distance education, 2) to examine several techniques for the analysis of interactions and the quality of the learning experience in a computer-mediated group conference, and 3) to propose a model for analyzing the social construction of knowledge in such a group conference. The paper provides guidelines for both designers and evaluators of web-based instruction.

The paper will examine the definition of 'interaction' in a computer-mediated communication (CMC) environment as definitions of 'interaction' for interpersonal communication used by communication researchers to study face-to-face dialogue do not transfer well to the CMC context. The paper will point out the strengths and shortcomings of interaction analysis techniques that have been developed and will propose a model for analyzing the quality of CMC interactions and learning experiences. The application of this model for analyzing interaction will be discussed briefly.

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DESIGNING INTERACTION IN WEB-BASED INSTRUCTION

The issue of 'interaction' has been an area of much debate in the practice of distance education. Often debated questions are: What type and level of interaction is essential for effective learning? How can we achieve interaction? What does synchronous (real - time) and asynchronous (time - delayed) interaction contribute? What type of interaction can the new interactive technologies provide? Is it worth the cost? Designers need to keep these questions in mind as they grapple with the task of designing 'interaction' for the web.

Examining instructional interaction in distance education, Moore (1989) makes a distinction between three types of interaction: learner- content interaction, learner- instructor interaction, and learner- learner interaction. This model serves as a useful guide for designing interaction in web-based instruction. Dinucci, Giudice, and Stiles (1998) discuss interactivity in web design as falling into three categories: users interacting with the web site itself, which is similar to learner - content interaction, users interacting with the site's publisher, similar to learner - instructor interaction, and users interacting with each other, similar to learner - learner interaction. They provide design guidelines for all three types of interaction using the unique technological capabilities of the WWW. The design issues related to these three types of interaction will be discussed in this section.

The interaction between the learner and content is the process of intellectually interacting with content that results in changes in the learner's understanding, perspective, or the cognitive structures of the learner's mind. This type of interaction could also be considered as 'system interactivity' when students work with a web-based instructional program where the system may adapt to their inputs or interactions.. Hyperlinking by which students navigate through the web, as well as web pages that interact with students by changing their form and displaying new information in response to the position of the cursor or to mouse clicks are ways in which learner - content interaction can be designed taking into consideration the unique features of the web. The multimedia capabilities and the hypertextual navigational tools of the web not only provide access to multiple perspectives but also provide some degree of control to learners as they try to make sense of the content.

The second type of interaction Moore (1989) describes is the interaction between the learner and the instructor, a type of interaction that is regarded as essential by many educators and highly desired by many learners. He states that the instructor is especially valuable in responding to the learners' application of new knowledge. Learners do not know enough about the subject to be sure that they are (1) applying it correctly, (2) applying it as intensively or extensively as possible, or (3) are aware of all the potential areas of application. 'It is for reality testing and feedback that interaction with an instructor is likely to be most valuable.' (Moore, 1989, pp. 3-4). In the web-based environment, this type of interaction can take place either between the individual learner and the instructor via private e-mail, or between a group of learners and the instructor in a group conferencing situation. The web-based environment is versatile in being able to provide for these types of interaction in a synchronous format (real-time audio, video, or text, or a combination of them), or in an asynchronous manner (time-delayed text).

Dinucci, Giudice, and Stiles (1998) observe that one of the most simplest and useful ways to open lines of communication between the learner and the instructor is including an e-mail feedback form using the 'mailto' feature built into HTML. However, 'mailto' only generates a message form and if the instructor requires more detailed feedback from the students, the designer may want to create fill-in forms. They note that creating such a form can be handled by standard HTML 2.0 code and by drag-and drop controls in most WYSIWYG HTML editors. Although you can create the form using HTML, in order to use the form interactively you need to use a programming language such as JavaScript. They note that JavaScript event handlers can be used with any form element to trigger interactions. Event handlers are commands that trigger actions whenever a certain event occurs - either an interactive event, such as the user clicking a button, or a noninteractive event, such as a page loading. When the event happens, the event handler can be used to run a JavaScript function in response to it. With new browsers, for example, those that support HTML 4.0 event handlers become really powerful. Any object on a page can react to user actions, as event handlers do things like trigger sounds and animation. Another method used to add interactivity is the use of plug-ins such as Shockwave for Director and Shockwave or Flash. However, the drawback is that learners have to have the plug-ins or be willing to download very large files. These more sophisticated techniques provide the combination of learner - content interaction and learner - instructor interaction. However, using more sophisticated technology on the web may prevent access for those learners who have a low end computer or internet connection. This is a factor that must be considered carefully by those who design web instruction for distance learners.

The third type of interaction, is the interaction that takes place between one learner and other learners, alone or in group settings, either in the presence or absence of an instructor. Moore (1989) notes that this type of interaction is a new dimension for distance education and will challenge our thinking and practice in the 1990s. It is also this type of interaction that would contribute immensely to a learner-centered view of learning, and provide the opportunity for the social negotiation of knowledge and construction of meaning. It is the evaluation of this type of learning that poses a critical challenge, and guidelines for this type of evaluation is presented in this paper.

It is the capability of the web to provide both chat sessions and forums for building communities, that is of most interest to adult educators who want to design instruction based on constructivist principles. These can be both synchronous or asynchronous. The 'Chat' feature allows learners to exchange text messages with other learners and the instructor in real time. The standard Internet protocol for chat is the 'Internet Relay Chat (IRC). Forums are asynchronous conferencing environments such as Netscape's Collabra or the WWWboard which are web-based, or stand alone online conferencing programs such as Lotus Notes or First Class. Most chat environments use a text-based interface, while some provide sound capabilities as well. As Dinucci, Giudice, and Stiles (1998) note newer systems offer graphic stand-ins called 'avatars' which users can use to represent themselves online. Others use VRML to create interactive 3D spaces in which your avatar can actually walk up to other users (or to their avatars) and exchange conversation, usually as text strings displayed in the window. However, these fanciful 3D environments may not be what the adult learner needs, and designers must carefully distinguish between the glitz and the goal of facilitating learning.

In order to enhance 'social presence' designers can add real-time videoconferencing such as CU-Seeme and NetMeeting. However, social presence can be facilitated in a text-based conferencing system without the addition of video by training the communicators involved in the communication transaction (Gunawardena, 1995). Gunawardena and Zittle (1997) have shown that social presence is a predictor of satisfaction in a text-based conferencing environment. Videoconferencing applications are not part of the web yet, but can be launched as helper applications or as browser plug-ins. One of the aspects that the designer needs to keep in mind is the limited bandwidth available for videoconferencing and issues related to access.

The design of asynchronous learning environments that facilitate interaction among learners and between the instructor and learners in a virtual group, is discussed elsewhere in detail (Gunawardena, 1998). It is the evaluation of learning that takes place in such an environment that is of interest to this paper and is discussed in the following sections.

Hillman, Willis, and Gunawardena (1994) argue that Moore's (1989) three types of interaction do not account for all aspects of interaction in technology-mediated distance education. They point out that the addition of high technology communications systems necessitates the conceptualization of an additional type of interaction: learner-interface interaction. They note that a facet of distance education that is increasingly overlooked is the effect of high-technology devices on interaction. Instructors and learners have to interact with the technology and manipulate interfaces in order to be able to communicate with each other. They state that it is important to make a distinction between the perception of interface as an independent, fourth mode of interaction, and the use of an interface as a mediating element in all interaction. In distance education, the interface itself is unlikely to be relevant to the subject being studied; it merely acts as a confounding intermediary between the three previously mentioned modes of interaction. The interface in this case has become an independent force with which the learner must contend. The web is a new medium for many adult learners an instructors and therefore designers must pay careful attention to training both instructors and learners to use this new medium if effective instruction is to take place. In order to address the learner-interface problem, Hillman, et al. (1994) suggest three types of activities to make the learner and instructor at ease with the technology. These include in-class exercises, orientation sessions, or technology credit courses.

In summary, the previous section has discussed issues that web designers need to consider if they are interested in facilitating the teaching -learning process for adults. It has provided guidelines for the design of three types of interaction discussed by Moore (1989), and the fourth type of interaction discussed by Hillman et. al. (1994). The following sections discuss several techniques for the analysis of interactions and the quality of the learning experience in asynchronous group conferences that facilitate learner - learner interaction, and propose a model for analyzing the social construction of knowledge in such a group conference.

EVALUATING INTERACTION AND THE QUALITY OF THE LEARNING EXPERIENCE IN GROUP CONFERENCING

A number of models for the evaluation of quality in computer conferencing are available. Hiltz (1990) describes analysis of the use of computer technology along four dimensions: 1) characteristics inherent to the technology, 2) social and psychological characteristics of users, 3) characteristics of groups adopting the technology, and 4) interaction of the preceding factors. Levin, Kim and Riel (1990) describe a method of analyzing the structure and content of interactions by the creation of 'message maps' which display graphically the interrelationships among the messages submitted to a conference. Levin, et al. use this analysis to identify 'threads' within a conference and to display the 'multithreaded' nature of conference interaction. They also practice identifying messages which are particularly 'influential' in producing numerous responses or lengthy sequences of responses and they diagram message flow described as the ebbing or flowing volume of messages in the conference. Henri (1992) proposes a system of content analysis which involves breaking messages down into units of meaning and classifying these units according to their content. Henri includes a quasi-quantitative 'participative' dimension of analysis in her scheme for content analysis which the authors feel is more properly considered as a separate issue from the more qualitative analysis of message meaning units. Henri's other four broad categories of content are described as 1) content which reflects the social dimension of conference interchanges, 2) content relating to the interactive dimension of the conference, 3) content indicating the application of cognitive skills, and 4) content showing metacognitive skills.

These models serve as a useful starting point for analyzing group interactions but one of the shortcomings of these models is that no specific criteria have been established for determining the quality of those interactions. Moreover, the definitions of interaction these models present are either unclear or not very applicable to the pattern of interaction observed in group conferences. Ravitz (1997) notes that the assessment of social interactions that occur online must use ethnographic approaches such as discourse analysis of messages that tell more about the interactions that occurred. He focuses attention on the importance of assessing questions such as 'How did the interactions change the participants?' and proposes one methodology described as the Interactive Project Vita.

The following section describes the development of an interaction analysis model by the author and her colleagues for examining the social construction of knowledge in group-based computer conferencing (Gunawardena, Lowe, and Anderson, 1997).

AN INTERACTION ANALYSIS MODEL FOR EXAMINING SOCIAL CONSTRUCTION OF KNOWLEDGE

The study undertaken by Gunawardena, Lowe, and Anderson, (1997) was interested in finding appropriate interaction analysis techniques that help address the following two evaluation research questions:

1. Was knowledge constructed within the group by means of the exchanges among participants? And

2. Did individual participants change their understanding or create new personal constructions of knowledge as a result of interactions within the group?

They examine the definition of 'interaction' in a computer-mediated communication (CMC) environment, explore strengths and shortcomings of currently available interaction analysis techniques, and propose a model based on grounded theory building for analyzing the quality of CMC interactions and learning experiences. The interaction analysis model was developed by analyzing the interactions that occurred in a professional development exercise; the ICDE95 global online debate conducted through asynchronous computer conferencing. The authors contend that the debate forms a particularly good example of collaborative construction of knowledge through social negotiation, a key feature of a constructivist learning environment. Fortunately, the computer provides a transcript that enables discourse analysis or interaction analysis.

In order to address the research questions posed above, a number of interaction analysis models were examined, and Henri's (1992) model selected as the most promising starting point. Three dimensions of this model, the interactive,

cognitive, and metacognitive, were selected as a framework for detailed analysis of the debate. However, it became clear that three aspects of Henri's (1992) model; its basis in a teacher-centered instructional paradigm, its distinction between the cognitive and the metacognitive dimensions, and its treatment of the concept of interaction, were unsuited for application to the debate. The authors therefore, developed a framework of interaction analysis that would be more appropriate for analyzing the debate transcript.

Gunawardena, Lowe and Anderson (1997) believe that the metaphor of a patchwork quilt better describes the process of shared construction of knowledge that occurs in a constructivist learning environment. A quilt block is built up by the application, one after another, of small pieces of cloth, which when assembled form a bright and colorful pattern. The pieces, according to this analogy, are the contributions of individual participants. Each participant contributes to the whole his or her own texture and color of thought, just as every scrap of fabric forms a distinctive element in the overall pattern. The pattern may not be complete during a single conference, but individual responses can contribute toward the formation of a pattern. The process by which the contributions are fitted together is interaction, broadly understood, and the pattern which emerges at the end, when the entire gestalt of accumulated interaction is viewed, is the newly-created knowledge or meaning. Interaction is the essential process of putting together the pieces in the co-creation of knowledge.

Based on this new definition of interaction, the debate was analyzed for the: 1) type of cognitive activity performed by participants (questioning, clarifying, negotiating, synthesizing, etc.), 2) types of arguments advanced throughout the debate, 3) resources brought in by participants for use in exploring their differences and negotiating new meanings, and 4) evidence of changes in understanding or the creation of new personal constructions of knowledge as a result of interactions within the group.

Grounded on this analysis an outline was developed of the process of negotiation which appears to occur in the co-construction of knowledge. The outline led to the development of the model which has five phases, reflecting the complete process of negotiation which must occur when there are substantial areas of inconsistency or disagreement to be resolved. The phases of learning outlined in this model occur at both the individual and social level and can be described as:
Phase I: Sharing/Comparing,
Phase II: Dissonance,
Phase III: Negotiation/Co-construction,
Phase IV: Testing Tentative Constructions, and
Phase V: Statement/Application of Newly-Constructed Knowledge.

In applying the model to the analysis of the debate it was evident that the debate format influenced the process of co-construction by sometimes supporting and sometimes hindering the efforts made by participants to reach a synthesis, a Phase III operation. The debate format supported Phase I by soliciting agreement on propositions, and Phase II by introducing inconsistencies between statements and helped to move the arguments to Phase III. However, the debate format hindered the desire of participants to reach a compromise or a synthesis at Phase III and above, as the debate leaders tried to keep the two sides apart.

Two major themes were observed. One was the progress of certain strands of argument from Phase I to Phase V which can be described as an exercise in the co-construction of knowledge, moving from lower to higher mental functions. The other was the evidence of more than one and sometimes three phases within a single message posted by one participant, which usually progressed in sequence through the phases, showing progress from lower to higher mental functions, showing how individuals contributed toward the co-construction. Detailed discussion of the application of the model to the analysis of the debate is found in Gunawardena, Lowe, and Anderson (1997). The efficacy of the interaction analysis model described above was tested in a second online forum (Anderson & Kanuka, 1998).

This paper has discussed the issues that web-designers must consider as they approach designing interaction that facilitates the teaching - learning process. It has also discussed issues that evaluators must consider as they begin to evaluate the learning that occurred as a result of that interaction. The paper has provided models for designing interaction and for evaluating the social construction of knowledge in web-based distance education.

References:

Anderson, T. & Kanuka, H. (1998). Evaluating the workplace center on-line forum: Knowledge construction and learningcommunities. Unpublished research report. Office of the Learning Technologies, Human Resources Development Canada, Ottawa, Canada.

Boshier, R., Mohapi, M., Moulton, G., Qayyum, A., Sadownik, L., & Wilson, M. (1997). Best and worst dressed web courses: Strutting into the 21st century in comfort and style, Distance Education, 18(2), 327-349.

Dinucci, D., Giudice, M., Stiles, L. (1998). Elements of web design. Berkeley, CA: Peachpit Press.

Gunawardena, C. N. (1998). Designing Collaborative Learning Environments Mediated by Computer Conferencing: Issues and Challenges in the Asian Socio-cultural Context. Indian Journal of Open Learning, 7(1), 105-124.

Gunawardena, C. N., & Zittle, F. (1997). Social presence as a predictor of satisfaction within a computer mediated conferencing environment.

American Journal of Distance Education, 11(3), 8-25.

Gunawardena, C. N., Lowe, C. A., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. Journal of Educational Computing Research, 17(4), 395-429.

Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer conferences. International Journal of Educational Telecommunications, 1(2/3), 147-166.

Henri, F. (1992). Computer conferencing and content analysis. In A. Kaye (ed.), Collaborative learning through computer conferencing: The Najaden papers (pp. 117-136). Berlin: Springer-Verlag.

Hillman, D. C., Willis, D. J., & Gunawardena, C. N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. The American Journal of Distance Education, 8(2), 30-42.

Hiltz, S. R. (1990). Evaluating the Virtual Classroom. In L.M. Harasim (ed.), Online Education, New York: Praeger.

Jonassen, D. H. (April, 1994). Thinking technology: Toward a Constructivist design model. Educational Technology, pp. 34-37.

Knowles, M. S. (1990). The adult learner: A neglected species, (4th ed.). Houston, Tx: Gulf Publishing.

Levin, J. A., Kim, H., & Riel, M. M. (1990). Analyzing instructional interactions on electronic message networks. In L. Harasim (Ed.), Online education (185-213). New York: Praeger.

Moore, M. G. (1989). Editorial: Three types of interaction. American Journal of Distance

Education, Vol. 3, No. 2, pp. 1-6.

Ravitz, J. (1997). Evaluating learning networks: A special challenge for web-based instruction, In B. H. Khan (Ed.), Web-based Instruction (361-368). Englewood Cliffs, NJ: Educational Technology Publications.

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